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BEHAVIORAL ASSESSMENT OF CONCRETE-FILLED STEEL TUBE STRUCTURES FOR SEISMIC EXCITATION

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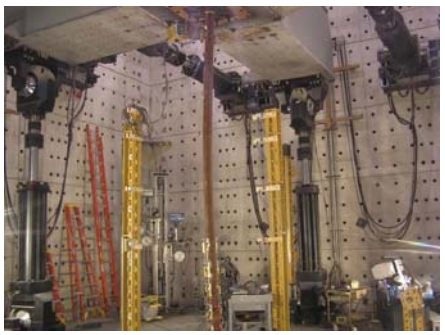
ABSTRACT



The assessment of response of composite seismic force resisting systems requires accurate nonlinear formulations for the composite members. This seminar summarizes research spanning several projects on the performance of composite concrete-filled steel tube (CFT) beam-columns as part of composite frame structures subjected to earthquakes. The work includes the development of damage parameters to characterize the progression of cyclic damage in CFTs; the development of two finite element formulations geared for three-dimensional nonlinear transient dynamic analysis of composite frames; ongoing research on full-scale experimental tests of CFTs subjected to multi-axial loading; and relation of this research to the U.S. design provisions for composite structures. The two finite element formulations include a stress-resultant-space beam-column element that uses a concentrated plasticity formulation to simulate cyclic CFT response, and a stress-based distributed plasticity fiber-based mixed finite element formulation for CFT beam-columns that provides detailed results of the primary stress-strain response as part of complete 3D frame analysis. Extensive validation against experimental tests is summarized.

Jerome F. Hajjar is a Professor and Narbey Khachaturian Faculty Scholar in the Department of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign. He has served as chair of the Structures Faculty for the last three years. From 2005-2007, he served as the Deputy Director of the NSF Mid-America Earthquake Center, and he has served as Information Technology Director for the NSF George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) experimental testing facilities at the University of Illinois and the University of Minnesota. His research and teaching interests include analysis, experimental testing, and design of steel and composite steel/concrete building and bridge structures, regional loss assessment, and earthquake engineering, and he has published over 100 papers and edited three books on these topics. Prior to joining the University of Illinois in 2005, he was a Professor at the University of Minnesota since 1992 and a structural engineer and associate at the architectural/engineering firm of Skidmore, Owings & Merrill in their Chicago and New York offices from 1988-1992. Dr. Hajjar is on the AISC Specification Committee and several of its task committees, including chairing Subcommittee 6 on Composite Construction for the AISC Seismic Design task committee; he is the past-chair of the NEES Information Technology Strategy Committee; and he is the past chair of the American Society of Civil Engineers (ASCE) Technical Administrative Committee on Metals. Hajjar was made a Fellow of ASCE in 2007, and was awarded the 2009 ASCE Shortridge Hardesty Award, the 2005 AISC T. R. Higgins Lectureship Award, the 2004 AISC Special Achievement Award, the 2003 ASCE Walter L. Huber Civil Engineering Research Prize, and the 2000 ASCE Norman Medal for his research on steel and composite structures, structural stability, and earthquake engineering. Dr. Hajjar is also a registered professional engineer in Illinois and Minnesota.